What is claimed is:

1. Apparatus for treating a volume of fluid, said apparatus comprising:

a fluid passageway through which the fluid flows;

at least one source of irradiation, external to said fluid passageway;

at least two reflecting troughs, each trough having a curved cross section, with a closed end, top and bottom edges, and an open end, the open end of each trough having first and second end edges, the open end of said first trough facing the open end of said second trough to define a space between the closed ends of said troughs, the top edges of said first and second troughs defining a first plane, and the bottom edges of said first and second troughs defining a second plane;

a first set of reflectors joining the end edges of said first trough to the end edges of said second trough, each reflector of said first set of reflectors having a top edge lying substantially in the first plane and a bottom edge lying substantially in the second plane; and

a second set of reflectors joining the top edges of said troughs and of said first set of reflectors and joining the bottom edges of said troughs and of said first set of reflectors, said second set of reflectors cooperating with said troughs and said first set of reflectors to define a substantially enclosed chamber having said at least one source of irradiation therein and having said fluid passageway passing therethrough, wherein:

each source of irradiation is within a respective one of said troughs, and

at least one of said fluid passageway and said at least one source of irradiation is spaced from all focal axes of said troughs so as to provide a substantially uniform irradiation distribution within the fluid in said fluid passageway.

2. Apparatus according to claim 1, wherein at least one of said troughs has a cross section defined by a plurality of segments of second order curves.

3. Apparatus according to claim 1, wherein at least one of said troughs has a cross section defined by a set of coordinates.

4. Apparatus according to claim 1, wherein at least one of said troughs has a cross section defined by a second order curve.

5. Apparatus according to claim 4, wherein the second order curve is a parabola.

6. Apparatus according to claim 4, wherein the second order curve is a portion of an ellipse.

7. Apparatus as claimed in claim 1, wherein each reflector of said first set of reflectors is a continuous reflector.

8. Apparatus according to claim 1, wherein each trough has a longitudinal axis, and wherein each reflector of said first set of reflectors is segmented and comprises:

a first flat reflector segment extending from a first one of said troughs at an angle to the longitudinal axis of such trough ; and

a second flat reflector segment extending from a second one of said troughs at an angle to the longitudinal axis of that trough and cooperating with said first flat reflector segment to define a V substantially midway between said troughs.

9. Apparatus according to claim 8, wherein the V forms an angle of substantially 90°.

10. Apparatus according to claim 1, wherein each reflector of said first set of reflectors is curved.

11. Apparatus according to claim 1, wherein each source of irradiation comprises a source of light for producing light to irradiate said fluid passageway.

12. Apparatus according to claim 11, wherein each source of light comprises a source of ultraviolet light.

13. Apparatus according to claim 12, wherein each source of ultraviolet light comprises a microwave electrodeless discharge bulb.

14. Apparatus according to claim 12, wherein each source of ultraviolet light comprises an arc discharge bulb.

15. Apparatus according to claim 12, wherein each source of ultraviolet light comprises a fluorescent discharge bulb.

16. Apparatus according to claim 11, wherein said fluid passageway has a central axis, and each source of light comprises a tubular bulb having a longitudinal axis substantially parallel to the central axis of said fluid passageway.

17. Apparatus according to claim 1, wherein said fluid passageway has a central axis, and each source of irradiation has a tubular shape with a longitudinal axis substantially parallel to the central axis of said fluid passageway.

18. Apparatus according to claim 1, wherein both said at least one source of irradiation and said fluid passageway are spaced from all focal axes of said troughs.

19. Apparatus according to claim 10, wherein each trough has a longitudinal axis, and said fluid passageway is on one of the longitudinal axes.

20. Apparatus according to claim 1, wherein each trough has a longitudinal axis, and said fluid passageway is spaced from all the longitudinal axes.

21. Apparatus according to claim 1, wherein said fluid passageway and said at least one source of irradiation are positioned so as to provide a substantially two-dimensionally uniform irradiation distribution across a cross-sectional plane of the fluid flowing in said fluid passageway.

22. Apparatus according to claim 1, wherein said fluid passageway and said at least one source of irradiation are positioned so as to provide a substantially three-dimensionally uniform irradiation distribution within a volume of fluid flowing in said fluid passageway.

23. Apparatus according to claim 1, wherein each trough has a focal axis within the trough, and each source of irradiation is positioned between the focal axis and the elliptical end of the respective one of said troughs.

24. Apparatus according to claim 1, wherein each trough has a first focal axis and a second focal axis, and the second focal axes of all of said troughs are substantially coincident.

25. Apparatus according to claim 1, wherein each trough has a longitudinal axis, and the longitudinal axes define a figure having a center of symmetry.

26. Apparatus as claimed in claim 25, wherein said source of irradiation has a longitudinal axis, and said fluid passageway has a central axis extending substantially through the center of symmetry of the figure and substantially parallel to the longitudinal axis of said source of irradiation.

27. Apparatus as claimed in claim 1, having a single source of irradiation and two troughs.

28. Apparatus as claimed in claim 27, wherein each trough has a focal axis, and said fluid passageway is on the focal axis of one of said troughs, and said source of irradiation is spaced from the focal axes and is adjacent the focal axis of the other said troughs.

29. Apparatus as claimed in claim 27, wherein each trough has a focal axis, and said source of irradiation is on the focal axis of one of said troughs, and said fluid passageway is spaced from the focal axes and is adjacent the focal axis of the other of said troughs.

30. Apparatus according to claim 27, wherein said two troughs have coinciding longitudinal axes.

31. Apparatus as claimed in claim 27, wherein said two troughs have non-coinciding longitudinal axes.

32. Apparatus as claimed in claim 31, wherein said two troughs have parallel longitudinal axes.

33. Apparatus as claimed in claim 32, wherein said source of irradiation has a longitudinal axis, and said fluid passageway has a central axis extending between the longitudinal axes of said troughs and substantially parallel to the longitudinal axis of said source of irradiation.

34. Apparatus according to claim 31, wherein said source of irradiation is on the longitudinal axis of one of said troughs and said fluid passageway is on the longitudinal axis of the other of said troughs.

35. Apparatus as claimed in claim 1, having two sources of irradiation and two troughs.

36. Apparatus as claimed in claim 35, wherein each trough has a first focal axis and a second focal axis, the second focal axes of said troughs

coincide, said fluid passageway is on the second focal axes, and each of said sources of irradiation is spaced from a respective one of the first focal axes.

37. Apparatus as claimed in claim 35, wherein each trough has a first focal axis and a second focal axis, the second focal axes of said troughs coincide, each of said two sources of irradiation is on the first focal axis of a respective one of said troughs, and said fluid passageway is spaced from the second focal axes.

38. Apparatus according to claim 35, wherein said two troughs have coinciding longitudinal axes.

39. Apparatus as claimed in claim 35, wherein said two troughs have non-coinciding longitudinal axes.

40. Apparatus as claimed in claim 39, wherein said two troughs have parallel longitudinal axes.

41. Apparatus as claimed in claim 40, wherein said sources of irradiation have parallel longitudinal axes, and said fluid passageway has a central axis extending between the longitudinal axes of said troughs and substantially parallel to the longitudinal axes of said sources of irradiation.

42. Apparatus according to claim 39, wherein said source of irradiation is on the longitudinal axis of one of said troughs and said fluid passageway is on the longitudinal axis of the other of said troughs.

43. Apparatus according to claim 1, wherein each trough has a longitudinal axis, and the longitudinal axis of each trough intersects the longitudinal axis of each angularly adjacent trough at an angle equal to $2\pi/N$, where N is the number of troughs.

44. Apparatus according to claim 43, wherein the longitudinal axes of the troughs intersect at a single intersection.

45. Apparatus according to claim 44, wherein said fluid passageway has a central axis passing through the intersection of the longitudinal axes.

46. Apparatus according to claim 43, wherein said fluid passageway has a central axis passing through the center of symmetry of a figure defined by the points of intersection of the longitudinal axes of said troughs.

47. Apparatus according to claim 43, having four sources of irradiation, and wherein N=4.

48. Apparatus as claimed in claim 47, wherein the longitudinal axes of said troughs intersect at a single intersection.

49. Apparatus according to claim 48, wherein said fluid passageway has a central axis passing through the intersection of the longitudinal axes.

50. Apparatus according to claim 47, wherein said fluid passageway has a central axis passing through the center of symmetry of a figure defined by the points of intersection of the longitudinal axes of said troughs.

51. Apparatus according to claim 1, further comprising a mount for each source of irradiation, making the position of each source of irradiation adjustable so as to provide a substantially two-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

52. Apparatus as claimed in claim 51, wherein each mount is adapted to be adjustably positioned on a mounting surface.

53. Apparatus as claimed in claim 51, wherein each source of irradiation is adjustably mounted to said mount.

54. Apparatus according to claim 1, further comprising a mount for each source of irradiation, making the position of each source of irradiation adjustable

so as to provide a substantially three-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

55. Apparatus as claimed in claim 54, wherein each mount is adapted to be adjustably positioned on a mounting surface.

56. Apparatus as claimed in claim 54, wherein each source of irradiation is adjustably mounted to said mount.

57. Apparatus according to claim 1, further comprising a mount for each trough, making the position of each trough adjustable so as to provide a substantially two-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

58. Apparatus as claimed in claim 57, wherein each mount is adapted to be adjustably positioned on a mounting surface.

59. Apparatus as claimed in claim 57, wherein each trough is adjustably mounted to one of said mounts.

60. Apparatus according to claim 1, further comprising a mount for each trough, making the position of each trough adjustable so as to provide a

substantially three-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

61. Apparatus as claimed in claim 60, wherein each mount is adapted to be adjustably positioned on a mounting surface.

62. Apparatus as claimed in claim 60, wherein each trough is adjustably mounted to one of said mounts.

63. Apparatus according to claim 1, further comprising an adjustable mount for said fluid passageway, making the position of said fluid passageway adjustable so as to provide a substantially two-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

64. Apparatus as claimed in claim 63, wherein said mount is adapted to be adjustably positioned on a mounting surface.

65. Apparatus as claimed in claim 63, wherein said fluid passageway is adjustably mounted to said mount.

66. Apparatus according to claim 1, further comprising an adjustable mount for said fluid passageway, making the position of said fluid passageway

adjustable so as to provide a substantially three-dimensionally uniform irradiation distribution within fluid flowing in said fluid passageway.

67. Apparatus as claimed in claim 66, wherein said mount is adapted to be adjustably positioned on a mounting surface.

68. Apparatus as claimed in claim 66, wherein said fluid passageway is adjustably mounted to said mount.

69. A method of providing a substantially two-dimensionally uniform irradiation distribution across a cross-sectional plane of a fluid flowing in a fluid passageway, said method comprising:

providing the apparatus according to claim 1;

positioning at least one of (a) said fluid passageway and (b) said at least one source of irradiation such that defocused irradiation from said at least one source of irradiation irradiates the fluid in said fluid passageway with a substantially two-dimensionally uniform irradiation distribution; and

activating said at least one source of irradiation.

70. A method of providing a substantially three-dimensionally uniform irradiation distribution within a volume of a fluid flowing in a fluid passageway, said method comprising:

providing the apparatus according to claim 1;

positioning at least one of (a) said fluid passageway and (b) said at least one source of irradiation such that defocused irradiation from said at least one source of irradiation irradiates the fluid in said fluid passageway with a substantially three-dimensionally uniform irradiation distribution; and

activating said at least one source of irradiation.

71. A method of providing a substantially two-dimensionally uniform irradiation distribution across a cross-sectional plane of a fluid flowing in a fluid passageway, said method comprising:

providing the apparatus according to claim 1;

shifting at least one trough such that defocused irradiation from said at least one source of irradiation irradiates the fluid in said fluid passageway with a substantially two-dimensionally uniform irradiation distribution; and

activating said at least one source of irradiation.

72. A method as claimed in claim 71, wherein said at least one trough has a longitudinal axis and is shifted in a direction substantially perpendicular to the longitudinal axis of such trough.

73. A method of providing a substantially uniform three-dimensional irradiation distribution within a volume of fluid flowing in a fluid passageway, said method comprising:

providing the apparatus according to claim 1;

shifting at least one trough such that defocused irradiation from said at least one source of irradiation irradiates the fluid in said fluid passageway with a substantially three-dimensionally uniform irradiation distribution; and

activating said at least one source of irradiation.

74. A method as claimed in claim 73, wherein said at least one trough has a longitudinal axis and is shifted in a direction substantially perpendicular to the longitudinal axis of such trough.

75. A method of treating a fluid flowing in a fluid passageway, comprising:

providing the apparatus according to claim 1;

passing a fluid through said fluid passageway;

irradiating the fluid in said fluid passageway with irradiation produced by said at least one source of irradiation; and

activating said at least one source of irradiation.

76. A method according to claim 75, wherein irradiating the fluid comprises irradiating the fluid with ultraviolet light.

77. A method according to claim 76, wherein said fluid includes a material to be disinfected, and wherein irradiating the fluid disinfects the material flowing in said fluid passageway.

78. A method according to claim 76, wherein the fluid includes a material to be purified, and wherein irradiating the fluid purifies the material flowing in said fluid passageway.

79. A method according to claim 76, wherein the fluid includes a material to be oxidized, and wherein irradiating the fluid causes oxidation of the material flowing in said fluid passageway.